Dolph
LD

5250

May 1965

HQS1-12
0039

PROJECT PLANS FOR THE 1965 BURNS TUSSOCK MOTH CONTROL PROJECT

By

Randall F. Perkins
John F. Wear
Robert E. Dolph
James W. Hughes
William V. Carpenter
Glenn L. Crouch

INSECT AND DISEASE CONTROL BRANCH, DIVISION OF TIMBER MANAGEMENT

PACIFIC NORTHWEST REGION — PORTLAND, OREGON

FOREST SERVICE — U. S. DEPARTMENT OF AGRICULTURE

C O N T E N T S

INTRODUCTION

Timber on portions of the Malheur and Ochoco National Forests of eastern Oregon is being threatened by the voracious Douglas-fir tussock moth. This timber destroyer threatens 16.5 million dollars worth of young trees and mature timber unless the defoliator can be controlled.

The Douglas-fir tussock moth (Hemerocampa pseudotsugata McD.) is one of the most destructive defoliators of true firs and Douglas-fir in western North America.

In 1929-30, the tussock moth killed 300 million board feet on the Colville National Forest in northeastern Washington. The largest known attack by this timber killer in 1946-47, hit 500,000 acres in northern Idaho, northeastern Oregon and eastern Washington. Nearly 2 billion board feet of fir timber was threatened before the biggest forest spray project undertaken up to that time brought the infestation under control. DDT was used, and control was achieved with little or no known side effects to other resources in the area.

On the Burns Project, only 15 acres were involved when this insect infestation was first detected in 1963. By 1964, the attack had grown to epidemic proportions involving more than 50,000 acres. Unless control is achieved in 1965, the infestation could possibly cover 200,000 acres.

The Malheur National Forest, where most of the attack is concentrated, has an annual allowable cut of 171 million board feet, the largest timber harvest of any eastside National Forest in the Pacific Northwest Region. Most of the mills in the area are dependent on National Forest timber, with milling capacity far greater than the timber available. Any loss of timber would result in a serious blow to the local economy.

The tussock moth has already killed immature timber on 1,950 acres and 2.6 million board feet of mature timber, totaling $219,000 in value.

Immediately threatened are 33,700 acres of young trees and 262.5 million board feet of mature timber, totaling $4.5 million in value.

Ultimately threatened, unless control is achieved, are 122,000 acres of immature timber and 950 million board feet of mature timber, totaling $16.5 million in value. The worth to the local economy in manufactured value and payrolls would be several times this amount.

The Forest Service plans to aerially spray approximately 55,600 acres in early June of 1965 to control this epidemic. Helicopters will be used because of their proven ability to apply insect controllants with maximum precision.

DDT, the only known effective insecticide against the tussock moth, will be applied at the rate of 3/4 pound in one gallon of fuel oil per acre. This use of DDT is far less than the rate of application normally used in most agriculture spraying, home gardens, and household use.

Sometimes infestations of tussock moth are controlled by the moth's natural enemies, including a virus disease. However, entomologists see no chance of this happening in time to prevent widespread tree morality in the case of the Burns infestation.

The Federal Committee on Pest Control, which must review all federally-financed aerial spray insect control projects in the United States, has approved the Burns Project. In addition, the Project has been endorsed by the Northwest Forest Pest Action Council, the Pacific Northwest Region's Forest Advisory Council, the Malheur National Forest Grazing Advisory Board, the County Courts of Harney and Grant Counties, and the Harney County Chamber of Commerce.

PLAN OF OPERATION

A. Biological Evaluation

Detection surveys in 1964 indicated that about 41,000 acres were infested with this insect. The infestations are in five separate areas ranging in size from about 600 acres to 24,000 acres. No previous insect control work has been done on these areas except for about 800 acres at the northern tip of the Antelope Unit which were sprayed in 1958 to control a spruce budworm epidemic. Spectacular damage and tree killing to timber and young trees occurred in 1964 with explosive suddenness. Intensive surveys indicated a strong upward trend in the moth population for 1965. Trends are indicated by the ratio of new egg masses to old. Ratios vary from one-to-one to fourteen-to-one. Severe damage and tree killing can be expected to continue unless effective control measures are taken in 1965 to minimize the threat to mature timber and young trees.

The detailed biological evaluation of the Douglas-fir tussock moth made during September and October, 1964, can be found in the Appendix.

The area of the 1965 control project has been increased from 41,000 acres to 55,600 acres in order to include adequate buffer zones of very light infestations.

B. Method of Control

The 1965 control plan is based on:

1. Cooperative aerial survey findings.

2. An on-the-ground evaluation by the Forest Service of the tussock moth distribution and biological potential.

3. An aerial and ground inspection of the tussock moth infestation by members of the Northwest Forest Pest Action Council; representatives of private, State and Federal agencies; and members of the County Court of Harney County and the Burns Chamber of Commerce.

4. The recommendations by the Council at its fifteenth annual meeting in Portland, Oregon on October 23, 1965.

5. The approval of the Federal Committee on Pest Control.

An analysis of the factors that determine the need for control for this tussock moth project (in relation to other successful control projects for spruce budworm and hemlock looper outbreaks) indicates that: (1) tree killing and infestation spread can be kept to a minimum; (2) the cost-benefit ratio is favorable and justified to protect timber and related resources; (3) natural control will not stop the epidemic before serious damage occurs.

The two principal objectives for direct control by aerial spraying of the Burns Tussock Moth Project are to protect currently infested stands from extensive tree killing and to prevent current infestation from spreading and jeopardizing adjacent timber.

Past experience shows that 3/4 pound of DDT in one gallon of fuel oil per acre should provide good control of the tussock moth. To maintain maximum precision in the aerial spraying, six high performance helicopters will be used to apply the insecticide on the Burns spray project. Three helicopters will be used to monitor the spraying application. Spraying techniques by helicopter insure protection of critical areas from contamination more effectively than fixed-wing aircraft. Of particular importance on this project are the range and water resources. Mountain meadows and other openings that will be used by cattle will not be sprayed. In order to protect fish and aquatic life, streams will be avoided.

Elevations of the spray areas vary from 3,800 to 7,100 feet. Egg hatch at the lower elevations can, of course, be expected to occur in advance of those at the higher elevations. The spray areas have been divided into spray blocks. Spray blocks will be released for spraying when egg hatch is general in that particular block.

The five control units were determined from aerial and ground surveys and detailed analysis of maps and aerial photographs. Boundaries of individual control units were established to include currently know infestations and buffer zones extending to logical land marks that the aerial applicator can easily identify from the air.

On the Malheur National Forest, the areas and approximate acreages are King Mountain, 23,760 acres; Antelope Mountain, 18,640 acres; Gold Hill, 9,100 acres; and Vance Creek, 570 acres. The one spray area on the Ochoco National Forest is Silver Springs with 3,530 acres.

Intensive helicopter and ground surveys will be made throughout the general area to locate any new infestations. These special surveys will start as soon as the areas are accessible and will continue until tussock moth larval feeding becomes evident. Any new areas discovered on these surveys will be sprayed to prevent further spread of the tussock moth.

C. Cooperation

The Burns Project is a cooperative control project among the private landowners, the State of Oregon, and the U.S. Forest Service. The basis for cooperation is set forth in the Federal Forest Pest Control Act of June 25, 1947, Oregon revised statutes relating to forest insect and disease control, and the subsequent cooperative agreement of January 2, 1961 between the Oregon State Board of Forestry and the Forest Service for the control of destructive forest insects and diseases. Cost-sharing and other specifics of the project are contained in a financial plan prepared jointly by the State Department of Forestry and the Forest Service.

Specific plans for the surveillance of associated resources within and adjacent to the spray area are contained in another section of this control plan. However, it should be mentioned that several Federal and State agencies are cooperating in this major effort to measure the effects of spraying upon other resources.

Federal agencies include:

Agricultural Research Service	Forest Service, Region 6
Bureau of Commercial Fisheries	Pacific Northwest Forest and Range Experiment Station
Bureau of Land Management	Public Health Service
Bu. of Sport Fisheries & Wildlife	

State of Oregon or County Agencies include:

Department of Agriculture	Game Commission
Department of Forestry	Oregon State University
Fish Commission	Sanitary Authority

County Agents

The Weather Bureau at Burns, Oregon is cooperating by providing special local weather reports. In addition, the Pendleton Weather Bureau will supply a mobile weather station and forecaster to make on-the-spot, local reports. Advice and assistance on aerial matters will be given by the Federal Aviation Agency as needed.

D. Financing

The total cost of the 1965 Burns Douglas-fir Tussock Moth Control Project is approximately $196,000.

The cost of the control project is shared by the governmental agencies and the private owners. The Federal Government pays the

entire cost for Federal lands and 25 percent of the costs for private lands. The State of Oregon pays the entire cost for State, County, and Municipal lands, and 37½ percent of the cost on the private lands. The private owners pay the remaining 37½ percent of the cost on their lands. The above formula is in accordance with the cooperative agreement of January 2, 1961 between the Oregon State Board of Forestry and the U.S. Forest Service.

Each Federal agency engaged in surveillance work pays its own costs. State agencies and private organizations pay their own costs unless otherwise agreed upon in cooperative agreements with the Forest Service. Private owners do not share in surveillance costs.

E. Organization

All operational and contract aspects will be a U.S. Forest Service responsibility. The State of Oregon is responsible for designating an infestation control district and determining the acreage of private land and collecting costs from the owners. The State will reimburse the Forest Service for control work on State and private lands.

Coordination and supervision of project will be through the Insect and Disease Control Branch of the Division of Timber Management, assisted by other Regional Office Divisions and the appropriate National Forests as needed.

The project director will be in direct charge with headquarters at Burns, Oregon. Project personnel, other than assigned Regional Office staff, will be detailed or assigned to the Malheur National Forest for administrative purposes.

F. Duties of Project Personnel

The project organization is shown in Figure 1. Responsibilities and duties of project personnel are combined and coordinated for maximum efficiency because of the relatively small size of this project.

Project Director - The project director is responsible to the Branch Chief of Insect and Disease Control for the planning and execution of the entire control project. He must plan, coordinate, administer and supervise the entire project, including preparation of the final written report. The principal duties are:

1. To plan, organize, and supervise the project.

2. To determine project requirements in personnel, equipment, supplies and services.

3. To prepare project plans and cost estimates.

4. To determine project boundaries.

5. To select and train project personnel.

6. To secure acceptance of the project by the public.

7. To work closely and harmoniously with Federal and State agencies concerned.

8. To conduct an effective, efficient and safe project at a reasonable cost with full consideration to protecting associated resources.

9. To prepare a comprehensive project report.

Assistant Project Director - The assistant project director is responsible to the project director for the efficient functioning of the spraying operation as assigned. He must be familiar with all aspects of the control project and assist the project director in securing an effective and well-coordinated spraying operation. On this project his major responsibility will be Air Operations Officer. The principal duties are:

1. Be familiar with all phases of the control operation.

2. With the aid of other technical personnel, delineate the spray and non-spray boundaries of the project.

3. Determine the acreage of spray blocks and prepare photo mosaics and maps for use of the pilot and project personnel.

4. With the assistance of the aerial consultant and the concurrence of the contractor, locate heliports and facilities for the safe and efficient use of helicopters.

5. Develop training plans as needed.

6. In charge of all aerial operations including observation. Duties under this phase include:

   a. Provide instruction and training to project personnel on individual work responsibilities of the aerial operation.

   b. Explain objectives and plan of action, aerial and ground hazards, and review safety plan.

   c. Develop good cooperation and understanding between contractor and project personnel.

   d. Make certain that spray pilots are properly briefed by chief pilot on block boundaries, flight patterns, critical fish streams, non-spray areas, etc., before starting to spray.

e. With the assistance of the contractor, aerial consultant and aerial observers, direct and inspect the application of insecticide by each pilot.

f. Observe each pilot's flying practices, height of flight, airspeed and flight pattern. Work through chief pilot to correct poor or unsafe practices.

g. Insure that all unsafe practices and equipment are corrected immediately.

h. At the end of each day see that all pilots are briefed on sufficient areas to carry them through the next day without having to break into the spray period.

i. Maintain continuous contact with the aerial observers, weather station, and heliport managers concerning safe flying and effectiveness of spray application. The decision to shut down spraying is based on many factors and may vary from one spray block to another. When weather conditions become critical (wind above six miles per hour and/or temperatures exceed 65° F) or spray materials are not settling into trees, a final decision will be made by the Air Operations Officer to shut down the operation for the day at each spray unit and relayed to the contractor through the heliport manager.

j. With the project entomologist, determine if spray coverage has been adequate. If respraying is necessary, recommend to the project director whether it should be done at the Government's or contractor's expense.

Project Entomologist - The project entomologist is responsible to the project director for entomological advice and for assistance in the entomological phases of the project. His principal duties are:

1. To prepare the entomological plan.

2. To devise adequate methods for sampling insect populations.

3. To devise means for appraising insect mortality following spraying.

4. To supervise the work of assistant project entomologist.

5. To train insect checkers in the entomological phases of the work.

6. To assist the project director in evaluating entomological data in forecasting the dates of spraying for the project.

Aerial Consultant - The aerial consultant assists and advises the project director on various phases of the helicopter spraying operation.

He works closely with the Air Operations Officer to maintain a safe and efficient operation. The principal duties are:

1. To advise and assist in project planning on:

   a. Heliport selection and traffic patterns.

   b. Helicopter requirements and specifications.

   c. Pilot requirements

   d. Observer training.

   e. Air safety requirements.

2. To inspect contractor's helicopters for airworthiness, contractual specifications, and suitability for the work.

3. To check the qualifications and proficiency of helicopter pilots.

4. To assist in the calibration of spray helicopters.

5. During spray operations, he will assist in checking:

   a. Aircraft maintenance and performance.

   b. Pilot performance.

   c. Adherence to air safety requirements.

6. To assist in the investigation of any air accidents.

7. To make administrative flights as requested by designated personnel.

Project Meteorologist - The project meteorologist is responsible to the project director for preparing and distributing weather information pertinent to the spraying operation. His principal duties are:

1. To prepare a weather reporting and forecasting plan.

2. To determine data needed and devise the necessary reports and forms.

3. To set reporting schedules.

4. To analyze weather data and make forecasts as needed.

5. To assist in the training of weather observers.

Administrative Officer - The project administrative officer serves as staff assistant to the project director. He is responsible for fiscal, clerical, and contract assistance and for advice to the project director. The principal duties are:

1. To prepare adequate plans for record and report keeping.

2. To train unit personnel in fiscal and clerical duties as needed.

3. To see that payrolls, vouchers, etc., are submitted promptly and properly.

4. To purchase supplies and arrange for equipment rentals, etc., as needed.

Aerial Observers - The aerial observers are responsible to the Air Operations Officer for information on all activities of spray application. The principal duties are:

1. Know the project unit boundaries:

   a. Know the block boundaries.

   b. Know the local landmarks.

   c. Know the communication blind spots.

2. During spraying, check to see that the helicopters stay within block boundaries and follow the flight patterns as set by the Air Operations Officer and chief pilot. See that deep canyons missed on contour flying are caught by flying down them. Check on proper swath overlap, shut off at end of spray runs and when crossing excluded areas. The time to spray out a load should be checked daily for each spray helicopter by use of a stop watch. Watch for leaky spray valves and nozzles and report them immediately.

3. Check on the spray swath for proper settling into the timber. Watch for drift and spray breakup due to air turbulence. Observe and report on local weather conditions. Recommend to the Air Operations Officer shut down when the spray drifts, rises, or starts to break up.

4. Check on all aircraft for safe flying practices and for observance of flight patterns to and from the block.

5. Assist pilots and Air Operations Officer in posting daily spray coverage on the progress map.

6. Maintain an accurate flight log.

7. Make written reports on unsafe flying practices observed, and on accidents or incidents pertinent to operations.

8. Know the search and rescue plan and be prepared to act immediately. Know helicopter landing spots for all blocks.

Heliport Managers - Each heliport from which aerial spraying will be conducted during an operating day will be manned by a heliport manager. His primary responsibility will be to monitor the entire operation at his assigned heliport. The principal duties are:

1. Supervise the loading of spray helicopters with insecticide and keep spray load records by helicopter and by block number (Form 25).

2. Check insecticide loads so as not to exceed allowable limits.

3. Maintain close surveillance on minimum gasoline requirements for each helicopter during the operating period each day.

4. Maintain accurate records of time of takeoff and landing of all helicopters using the heliport (Form 25). When changing heliports, advise the monitoring helicopter and the Air Operations Officer.

5. Report to the Air Operations Officer all leaks and helicopters coming in with open dump valves. Helicopters with minor leaks or drooling nozzles should be grounded until corrections are made. Maintain a record of all conditions of this type.

6. Report immediately any helicopter that is overdue to the Air Operations Officer and alert the monitoring helicopters.

7. Observe loading area practices and report unsafe procedures observed.

8. Observe landings and takeoffs for conformance with prescribed flight patterns and safety procedures.

9. Maintain constant radio standby during all periods of heliport operations. Record all significant messages received or sent.

10. Report to the Air Operations Officer the volume of insecticide loaded each day per helicopter.

11. Be familiar with the search and rescue plans and be prepared to handle all emergency communications accordingly.

12. The heliport manager will shut down each helicopter upon request of the Air Operations Officer. However, if the Air Operations Operator is not available and circumstances warrant, he will shut down each helicopter after consulting with weather observer and observation helicopter.

Assistant Entomologist - The assistant project entomologist will be in charge of the technical staff during the absence of the project entomologist. Duties of the assistant entomologist will be to:

1. Become thoroughly familiar with each control unit--maps, mosaics, roads, boundaries, elevations, blocks, egg-larval collection points, and larval mortality points.

2. Make twice-weekly egg observations to determine hatching period.

3. Advise the project entomologist as to rate of egg hatch on project.

4. Assist the project entomologist in choosing larval mortality sampling points and preparing work schedule for all technical personnel and post this schedule one or more days in advance.

5. Sample larval mortality and lay out and collect spray deposit cards when the insect checkers are busy with other duties.

6. Assist the project entomologist in estimating spray deposit on oil-sensitive spray deposit cards.

7. Confirm all communications--radio messages, telephone conversations, verbal reports, etc., in writing.

Insect Checkers - The insect checkers will be trained by the project entomologist who will be responsible for the overall supervision of their work; however, they will be under the immediate supervision of the assistant entomologist. The duties of an insect checker will be:

1. Become familiar with the control units in which they will be working.

2. Make twice-weekly egg observations to determine when they hatch when the assistant entomologist is busy with other duties.

3. Make prespray and post-spray larval counts on mortality plots.

4. Serially number and distribute spray deposit cards before spraying and collect them after spraying.

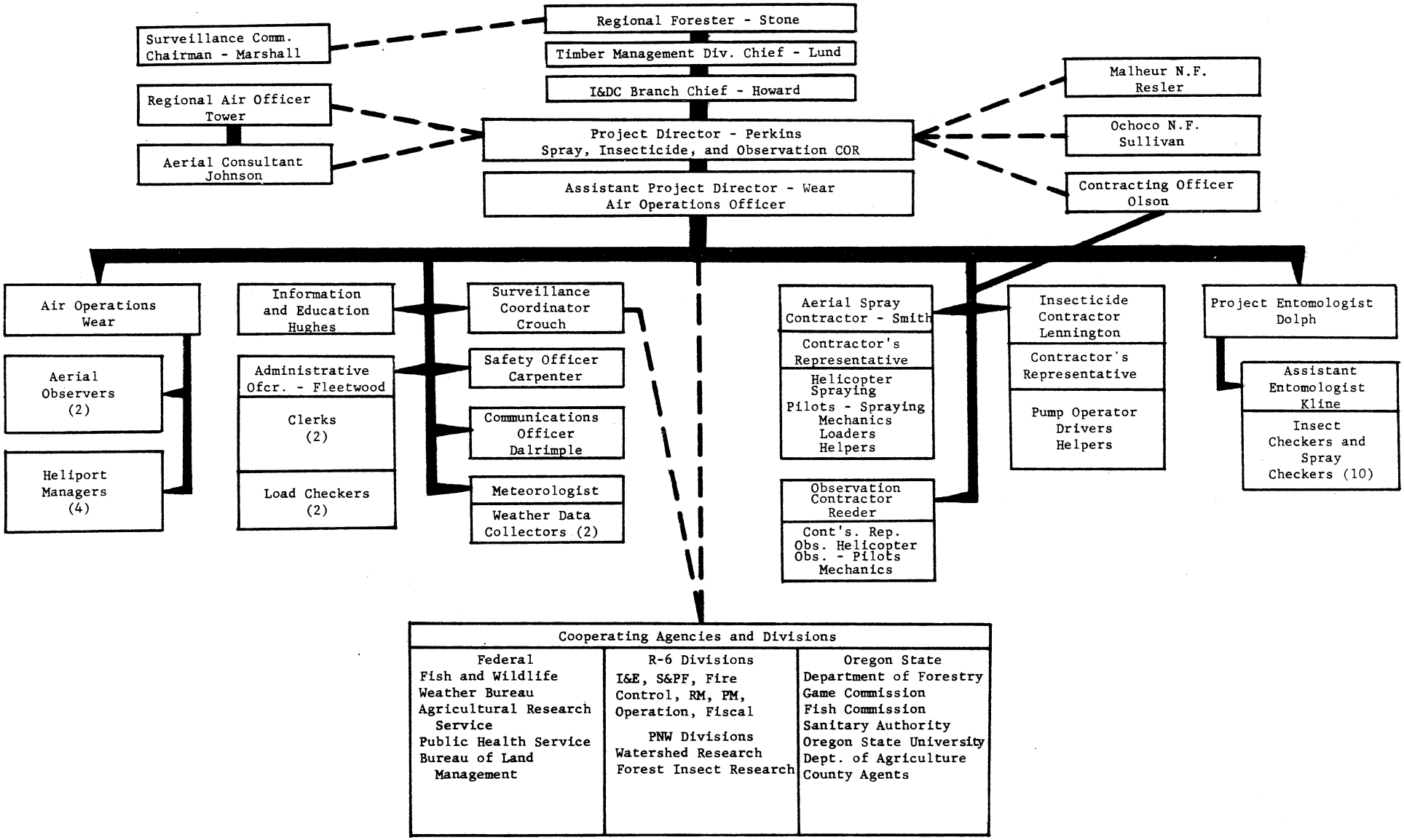
5. Deliver the sprayed cards to the assistant entomologist the same day as collected, if possible.

6. Observe the performance of spray planes whenever possible.

7. Do other work as assigned by the project entomologist or assistant entomologist.

Weather Observers - The weather observer takes accurate data on local weather conditions as instructed by the project meteorologist. He reports data on pre-arranged schedule to the heliport managers. Any pertinent information observed on the distribution or characteristics of the spray should be reported to the observation helicopter.

Figure 1.--1965 BURNS TUSSOCK MOTH PROJECT
ORGANIZATION AND PERSONNEL

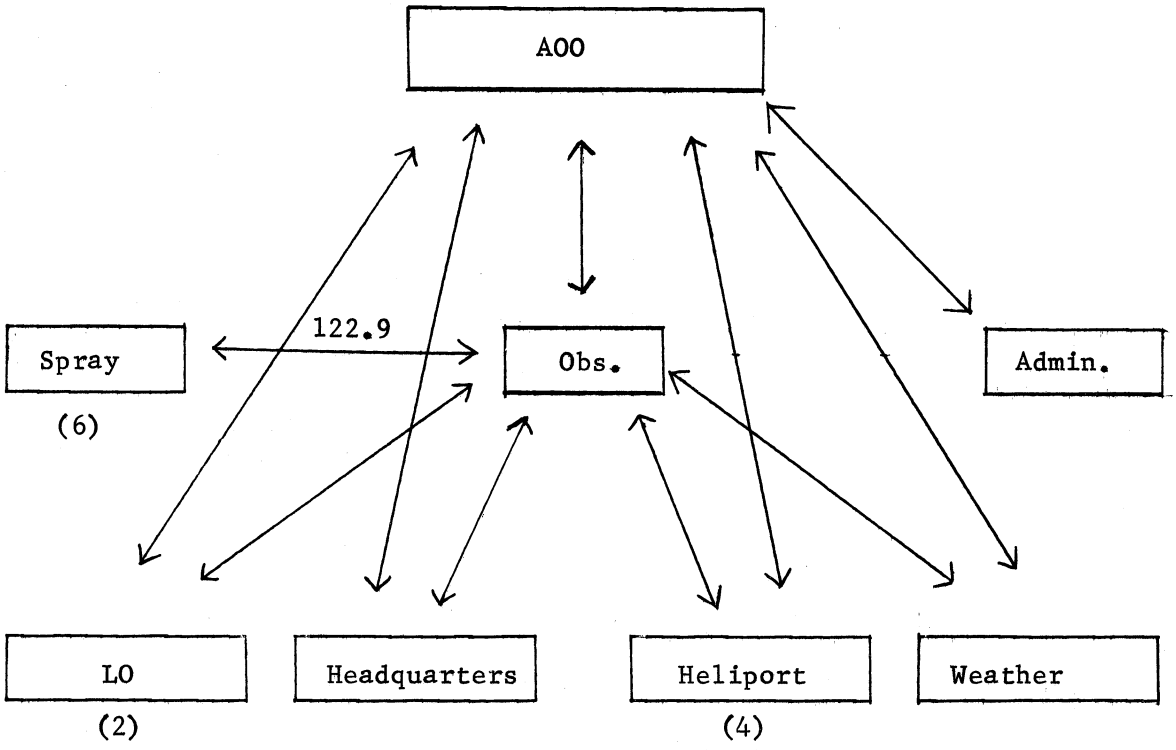


G. Communications

The Burns Tussock Moth Control Project requires **continuous** and reliable communications for an efficient and safe aerial spraying operation. The five control units are spaced approximately 15 miles apart and range from 10 to 48 miles from project headquarters at Burns. Communications are needed between headquarters, heliports, lookouts, weather points, administrative helicopter, observation helicopters, and spraying helicopters.

The observation helicopters will be the center relay point between heliport, spray helicopters, lookouts and headquarters for the aerial operation. The Air Operations Officer will coordinate and maintain contact with ground and aerial operations. The communications intertie between units is as follows:

RADIO INTERTIE



Basic Communications

1. Ground-to-ground - Use the Forest frequency at all times. (Heliport to lookout, weather, headquarters, etc.) Telephone will be used for ground communications when available, especially for long messages (weather).

2. Ground-to-air and air-to-ground - Use Forest radio (Observation helicopter to heliport or headquarters.)

3. Air-to-air - Use 122.9 VHF frequency. (Observation helicopter to spraying helicopter.

4. Priority of use

a.	Mayday (distress)	Aircraft in trouble	122.9 VHF and FS Frequency radio
b.	Ground accident	Type, severity, assistance needs	Forest frequency radio
c.	Spraying instructions		122.9 VHF
d.	Weather data		Forest frequency radio or telephone
e.	Routine control information		Forest frequency

Radio Procedures

1. Standard communications - Minimize talking--say it; shut up! Use 4 and 10 codes.

a. Call facility or equipment. Use control unit name, facility or helicopter, and number; i.e., "King heliport #5; this is King helicopter #1."

b. Acknowledge - "This is heliport #5."

c. Brief message ' "..., over."

d. Acknowledge - "Heliport #5, 10-4."

2. Safety communications

a. Aerial emergency, Mayday

(1) Spray aircraft in trouble gives its precise location to observation helicopter. If time available, advise as to

nature of problem and intended action.

(2) Observation helicopter relays information on Forest radio to air operations officer and headquarters. Orbit position, relay information through second observation helicopter on 122.9, or to heliport manager on Forest frequency radio.

(3) If an observation helicopter is in trouble it calls Air Operations Officer or advises second observation helicopter on 122.9 VHF to orbit for possible assistance.

(4) A Mayday alert silences all radios except the helicopter in trouble, Air Operations Officer, and the orbiting helicopter.

(5) Air Operations Officer will initiate all extensive search and rescue operations.

(6) An accurate log of radio communications for emergencies or search and rescue will be kept by headquarters.

b. Aerial emergency, spraying helicopter overdue

(1) Heliport manager alerts observation helicopters and Air Operations Officer on Forest radio if spray helicopter is overdue more than 15 minutes.

(2) The two observation helicopters start search for downed aircraft near last known location or spray block.

(3) Keep Air Operations Officer and heliport manager advised by radio on progress of search and rescue.

(4) Administrative helicopter (if at Burns airport) will stand by for instructions on search or doctor pickup as needed.

c. Ground emergency

(1) Advise headquarters immediately by Forest frequency radio on seriousness of any accident of major concern.

(2) Minor accidents should be handled immediately on a local basis.

Radio Needs

1. Each observation helicopter will have the following radios:

a. VHF commercial radio frequencies including crystal control on 121.5, 122.8 and 122.9.

b. FS radio on the Forest frequency supplied by Forest Service (portable unit).

2. Each spray helicopter will have the following radio:

a. VHF commercial radio frequencies including crystal control on 121.5, 122.8 and 122.9.

3. Headquarters will have the following communications:

a. FS radio on Forest frequency (portable unit).

b. Telephone

4. Each heliport, lookout and weather facility will have an FS radio on Forest frequency supplied by Forest Service (portable unit).

H. Safety Plan

Policy and Objectives

The Forest Service Safety Policy is outlined in FSM 6179.11 and Chapter 1 of the Forest Service Health and Safety Code.

The Forest Service Safety Policy is applicable to both contractor and Forest Service operations. Each employee, contractor or Government, shall understand this policy and must be aware that he has a responsibility in the prevention of accidents on this project.

The objectives of the Douglas-fir Tussock Moth Safety Plan are to carry out the spray program with no fatalities, no lost time injuries and no property damage accidents in either the Forest Service or contractor organization. Accident prevention and safety code compliance shall take precedence over immediate job production, with SAFETY ALWAYS FIRST.

Relationship of the Contractors to This Safety Plan

The contracts for aerial spraying and insecticide include provisions, based upon previous experience, to safeguard this hazardous operation.

The contractors have agreed to the terms of the Invitation to Bid, but it will be necessary that the contract safety provisions be understood in detail by the project director, discussed with the chief pilot to gain mutual understanding, and enforced with only such modifications as have prior approval of the Regional Office and written agreement of the contractors.

Safety Program

1. Heliport and spray operations

a. DDT is hazardous if swallowed, inhaled or absorbed through skin. Washing facilities shall be provided at each active heliport to be used for flushing insecticide from skin.

b. A wind indicator will be placed at all heliports.

c. Takeoff and landing pattern established for a heliport shall be used by spray and observation craft.

d. Spectators will be restricted from loading areas.

e. At least one 15-pound CO^2 and one 3-pound chemical extinguisher, supplied by the spray contractor, shall be kept at each active heliport.

f. All insecticide filler necks shall be painted green.

g. Helicopters shall be cleaned of overflow insecticide or fuel.

h. NO SMOKING within 50 feet of any refueling or insecticide equipment. A smoke break area will be designated at each heliport.

i. A minimum of 30 minutes reserve fuel over the estimated amount required for each flight shall be carried in spray and observation helicopters.

j. All personnel shall stay clear of tail boom or tail rotor.

k. DO NOT approach the helicopter until pilot signals you to do so, and then from the side or front in full view of the pilot--KEEP YOUR HEAD DOWN.

l. Pilots shall be alerted to potential hazards such as radar towers, power lines, tall snags, etc., during the orientation flights.

m. Spray planes will not carry passengers while spraying.

n. Spray plane pilots will wear safety belts and crash helments.

o. Pilots using unsafe practices will be grounded.

p. Helicopter windshields shall be clean at all times.

q. Spray helicopters will not load with insecticide after operations are suspended for the day.

r. Strike-anywhere matches will not be carried by pilot or passengers on flights.

s. The pilot may cancel any flight when he believes existing or pending conditions make it unsafe.

t. Observation helicopter pilots and observers shall wear seat belts.

u. All personnel connected with the aerial operations will carry ground-air signals.

2. Heliport managers shall

a. Be made aware of the hazards when working around pesticides and gasoline.

b. Observe and enforce safety rules posted at the heliport.

c. Report to Air Operations Officer immediately all helicopters that are 15 minutes overdue.

d. Be alert to rotating helicopter blades.

e. Wear protective work clothing and goggles as necessary.

f. Wash off any insecticide or gasoline which gets on the skin.

g. Change work clothes daily if handling insecticide.

h. Keep visitors a minimum distance of 100 feet from loading area.

3. Personnel assigned to field work shall

a. Be familiar and comply with FS Health and Safety Code, 5.21.

b. Wear logger-type shoes with non-skid soles and a snag-resistant shirt and trousers.

c. Be properly briefed on getting to and from work areas.

d. Carry first-aid kits, compasses and pocketknives.

e. Know what to do in event of becoming lost or injured.

f. Be fully aware of poisonous nature of hairs covering the tussock moth.

4. Office personnel shall

a. Observe all safety items as outlined in the FS Health and Safety Code 8.41.

b. Know procedure to follow in case of an emergency. An outline of proper procedures is posted by the project headquarters radio.

5. Vehicles (FS Health and Safety Code 2.1)

a. Vehicles, owned or leased by the Forest Service, shall be driven only by physically fit employees who have qualified for and hold both State driver's license and Government operator's identification card, and who shall be thoroughly familiar with Section 2.1 of the Safety Code.

b. All drivers shall practice DEFENSIVE DRIVING.

c. All 4x4 jeep drivers shall take extra care not to overextend the capabilities of this vehicle.

d. Any accident which occurs shall be reported to the employee's immediate supervisor who will take appropriate action.

Any safety program which is developed prior to actual operations should be flexible enough to permit frequent revisions as new dangers and hazards are encountered.

It will take constant alertness to recognize the hazards, and very close supervision to see that training is carried out as planned, and that work supervisors actually check and double check every operation.

I. Search and Rescue

The following outlined procedures are to be used in case of a down or missing helicopter. This plan can be modified as needed with approval of the project director.

Preventative Measures

1. Each spraying helicopter will be assigned a specific spray block which will be recorded with the heliport manager (Form 25). Any side trips must be approved by the heliport manager.

2. Helicopters shall carry 30 minutes extra fuel on each trip.

3. Departure and return time will be recorded.

4. Spray craft will jettison load if in serious trouble. Pilot will report jettison location and make a written statement of the course to the project director.

5. There should be a vehicle present at each active heliport to serve as an ambulance. (Equipment: radio, first-aid kit, fire extinguisher, stretcher and fire tools.)

Search Plan

1. If a helicopter is missing, overdue, or down, the heliport manager will contact the Air Operations Officer, and headquarters

through the observation helicopter. As much detail on the last known position of the missing helicopter, spray block and normal route of flight to and from the heliport should be determined and made available. If the Air Operations Officer cannot be reached in a short time, the aerial consultant, or the safety officer will conduct the search and rescue operation.

2. The observation helicopter will first make a visual scan of the air for the missing helicopter in the spray block area. Radio failure may be the only problem.

3. The observation helicopter will start an intensive search of the sub-spray block for the possible crash site. Continuous radio contact will be maintained with the heliport manager.

4. If unable to locate the missing craft immediately, the Air Operations Officer will determine the area to be searched and the helicopters to be deployed for the search. Two observation helicopters, the administrative helicopter, and only one or two spray helicopters (minus spray load) may be expected to participate in the search.

5. Headquarters will contact the following in case of a serious emergency:

a. Notify Oregon State Board of Aeronautics, Federal Aviation Agency, and Civil Air Patrol. (See Emergency Telephone List at the end of this section.)

b. Alert regional fire dispatcher:

Regional Dispatcher	Location	Telephone
Clarence Edgington	Portland, Oregon	234-8211 Ext. 559 or 504

Regional Air Officer	Location	Telephone
Wallace Tower	Portland, Oregon	234-8211 Ext. 504
		252-8577 (home)

Insect & Disease Branch Chief	Location	Telephone
Benton Howard	Portland, Oregon	234-8211 Ext. 340
		234-6253 (home)

c. Alert the appropriate forest supervisor:

Forest	Forest Supervisor	Telephone
Malheur	Rexford Resler	John Day - 860
Ochoco	Leslie Sullivan	Prineville 447-6247

d. Notify district ranger of district involved:

District	Ranger	Telephone
Burns	Stewart Hanna	573-2016
Snow Mountain	Calvin Weissenfluh	573-2018
Prairie City		923-5501
Long Creek	Blen Holman, Jr.	860 - John Day

e. Notify Oregon State Police (Emergency Telephone List).

f. Alert nearest ambulance, hospital and physician (Emergency Telephone List).

g. Alert the medical investigator in case of death (Emergency Telephone List).

Rescue Plan
(When downed craft is located and reported.)

1. Orbiting helicopter will check area for safe landing at or near the site, land, render assistance, and make pickup if possible.

2. Ambulance may be ordered to nearest designated emergency location if patient cannot be removed by helicopter.

3. Doctor will be standing by at designated emergency location for transportation by helicopter if necessary.

4. Rescue team will inform Air Operations Officer and headquarters of crash victim's condition.

5. District ranger, forest supervisor, and Regional Office will be informed of progress at all times.

6. Division of Information and Education will be requested to advise on release of information

7. In case of a fatality notify the medical investigator.

8. In case of a fatality the employer will notify next of kin.

9. An accurate log of search and rescue operations will be kept by headquarters.

10. Collect names and statements from all witnesses.

General

1. All personnel will carry a copy of ground-to-air visual signals.

2. Emergency telephone numbers are listed at the end of this section.

3. Things to remember:

a. One person is in charge.

b. Don't be ashamed to ask for relief--person in charge can unknowingly become mentally exhausted.

Emergency Telephone List

AMBULANCE

High Desert Air Ser. 24-hour service 4 & 6 pass. plane	573-6784
Oscar Davis 4 place plane	573-2993

GROUND AMBULANCE

Dial 0 for Operator	DIAL - 0
For information: Jim Richardson	573-2633

HOSPITAL

Harney Co. Hospital	573-2034

PHYICIANS & SURGEONS (MD)

	Burns Clinic	Home
J. Weare	573-2074	573-2966
D. Sinkey	"	573-6666
R. Morrison	"	573-6222

MEDICAL INVESTIGATOR

John Weare	573-2074
Home	573-2966

DENTIST

Robert Fulton	573-2141
Home	573-6822

POLICE

Dail 0 for Operator	DIAL - 0
State Police For information: A.O. Pollentier	573-2566
County Sheriff For information: Eldon Sitz	573-6156

FIRE

Dial 0 for Operator	DIAL - 0

OREGON STATE BOARD OF AERONAUTICS' REPRESENTATIVES

Burns Airport John Hopkins, Mgr.	573-6784
John Day Airport Phil Boyer, Mgr.	89

FEDERAL AVIATION AGENCY and CIVIL AERONAUTICS BOARD

5410 NE Marine Dr. Portland, Oregon	288-5846 or 282-7293

FOREST SERVICE OFFICES

R.O. Portland Clarence Edgington	253-7322
Division of Timber Management, Insect & Disease Control Branch	234-8211 Ext. 340
Malheur, Burns Stewart Hanna	573-2016
S.O. John Day Rexford Resler	860
Snow Mt. Dist. Hines Cal Weissenfluh	573-2018

J. Insecticide and Aerial Contracts

Contracts for the Burns Tussock Moth Control Project were developed by the Forest Service with the assistance of specialists in the many technical, industrial and aviation fields. Federal and State rules and regulations, and safety requirements applicable to all phases of the control operation were determined and incorporated in the three different contracts.

The insecticide and the transportation and storage of insecticide are included in a single contract. The technical grade DDT, formulation with fuel oil and solvent, transporting to the project area, storing the insecticide at specified locations in a safe and suitable manner, and the removal of tanks and cleaning up the storage area at the project are the successful contractor's responsibility. Provisions were made for adequate testing of insecticide formulations, inspection of facilities, and checking volumes of materials delivered. Formulated materials were checked with the Argicultural Research Service Laboratory at Yakima, Washington for conformance with Federal specifications. Inspections and checks will be made by Forest Service personnel.

The aerial spraying contract specifies the type of helicopters required to accomplish a safe and efficient spraying operation. Specifications for all phases of the aerial operation are provided to simplify and maintain a realistic control operation. Bids are submitted on a cost per acre basis for approximately 55,600 acres.

The aerial observation contract specified two helicopters on an hourly basis. Helicopter specifications will be the equivalent of the spraying helicopter because two observers and a pilot will be observing at various times during the project.

ENTOMOLOGICAL PLAN

The 1964 cooperative forest aerial survey recorded over 41,000 acres of epidemic tussock moth infestations on the Malheur and Ochoco National Forests near Burns, Oregon. The epidemic defoliation occurred at five centers. In mid-October, a tussock moth egg survey at 30 selected plots on three of the largest infestation areas, showed a strong upward trend in the feeding population for 1965.

After considering the amount of current damage and the increasing trend and lack of natural control factor, the Northwest Forest Pest Action Council at its meeting on October 23, 1964 recommended aerial spraying of the epidemic infestation and sufficient lightly infested buffer zones to control the outbreak.

It is the responsibility of the Insect and Disease Control Branch to provide survey data on which control recommendations can be based, participate in control planning, provide guidelines and procedures to insure the biological soundness of control operations, inspect operational procedures for entomological soundness, analyze the results of control operations and furnish reports as needed.

An entomologist, an assistant entomologist and ten insect checkers will be needed for the proper conduct of the biological phases of the 1965 project. The assistant entomologist and insect checkers will be hired by the Malheur National Forest.

These men will be trained by and directly responsible to the project entomologist as shown in the organization chart in the control plan.

All technical personnel of the 1965 tussock moth control project will observe safe working practices as set forth in the Forest Service Health and Safety Code and in the Project Safety Plan.

Biological Phase of the Project

Technical personnel will determine: (1) when tussock moth eggs hatch in each spray block unit, (2) spray distribution, (3) tussock moth mortality caused by insecticide, and (4) other arthropods killed by the spray. The results of observations and studies to determine each of these points will be reported after the project is completed.

EGG-LARVAL OBSERVATIONS

Egg hatch will be determined by observing egg masses from understory and overstory foliage in true fir stands on individual spray blocks. Egg hatch may occur any time between May 25 and June 20. Start of spraying operations in each spray block will begin when egg hatch is general.

Procedures for making egg mass hatching observations will be:

1. The project entomologist, assistant entomologist, and insect checkers will determine as closely as possible the dates when the overwintering eggs hatch at various elevations. Observations should be made in various elevational zones to determine the date on which the first instar larvae are first seen crawling on their egg masses. Accurate records will be kept for each sampling point.

2. The project entomologist will select at least one observation point within each control unit. The points will be selected in areas containing moderate to heavy tussock moth populations last year. Samples may be collected at random to supply more developmental data when desired. Plot location records will be kept by the project entomologist or assistant entomologist.

3. The assistant entomologist will establish representative observation points for each insect checker. Ganerally, these points will be on a line from creek bottom to ridge top. Observation points should be spaced at least 20 chains apart.

4. The procedure for observing egg hatch consists of tagging a total of 25 egg masses, 5 each on 5 trees at each plot center. Tags will be provided (Appendix). Each center will be visited twice-weekly, and each egg mass will be observed to record egg hatch. This information will be recorded on Work Sheet #15 (Appendix). These forms will be returned to assistant entomologist either the same day the observation was made or the following morning.

Spray blocks will be released for spraying when egg hatch is general in all elevational zones. Spray blocks will be split as necessary to accommodate development. The hatch at lower elevations may occur a little in advance over that at higher elevations. Observations of egg masses from both elevations should determine this. Work Sheet #16 will be completed by the project entomologist and submitted to the project director when blocks are released for spraying. Spraying priorities will be listed on this form. Spraying should begin between May 29 and June 5.

MORTALITY COUNTS

If possible, the project entomologist or his assistant will select at least one mortality plot in each of the spray blocks to sample for insecticide-caused tussock moth mortality. Some blocks may not be accessible or contain a moderate to heavy tussock moth population. In this case, no mortality plot will be sampled in these blocks, but more than one plot will be established in other more accessible and more populated blocks. Each mortality plot will be sampled one or two days before spraying and on the third and tenth day after spraying.

Procedure for sampling larval mortality as a result of aerial spraying will be:

A. Before Spraying

1. One or two days before a block is sprayed, a mortality line will be established perpendicular to the general spray pattern for each block. These lines can be established along trails and forest roads to facilitate checking; provided, the roads or trails are not in creek bottoms or along ridge tops. Plots should be established 5 chains (330 feet) apart if distances are paced and 0.2 miles apart if along roads. Each station will be tagged or marked.

2. Just before spraying, collect 100 tussock moth larvae at each plot center. Place the larvae in a 2 square-foot mortality tray, use tanglefoot around top of tray and cover with a lid to prevent larvae from crawling out of tray. Lids will be removed from tray prior to application of insecticide and then replaced after the area has been sprayed. In addition, a few drop cloths will be placed under key trees to collect insects and arthropods that may be affected immediately after spraying.

B. After Spraying

1. Immediate knock down effect of spray will be noted the day of spraying.

2. After a mortality plot has been sprayed, the lids will be replaced on each mortality tray. Three and ten days later, each tray will be visted again to examine larvae. Live larvae will be separated from the dead larvae at each tray and placed in a vial. The dead larvae will be placed in a vial containing 70 percent alcohol. Each vial will be properly labeled with a tag (Appendix). Any other arthropods found in a tray will be placed in a separate vial. All vials will be given to the project entomologist or the assistant entomologist on the day of collection.

The same procedure will be followed when examining the drop cloths. Caution: be sure the vials are properly labeled!

3. The project entomologist and assistant entomologist will compute larval mortality.

The following formula will be used to compute tussock moth mortality resulting from spraying:

$$\text{Percent Mortality} = \frac{\text{Prespray - post-spray count} \times 100}{\text{Prespray count}}$$

4. Each larva collected will be separated by instar. Head capsule widths will be used to determine the different instars of development (Appendix). The number of larvae in each instar will be recorded on Worksheet #17.

5. Estimates of the current year's defoliation and cumulative tree mortality will be made when spraying is finished.

6. An egg mass survey will be made on all areas in the fall. Results from this survey will be compared with 1964 data to obtain final control effectiveness.

Amount of distribtuion of spray reaching the ground in the project area and at the side of critical streams and meadows will be assessed by the technical staff. Oil-sensitive 4x5 spray deposit cards placed in areas sprayed with DDT in fuel oil will pick up droplet patterns from which spray density can be estimated.

Each 4x5 spray deposit card will be serially numbered and stapled to an 8x10-inch heavy cardboard. Spray deposit cards will be placed in areas the day before spraying. One or more card lines per block should be established. The lines will run perpendicular to the spray pattern for each block. Roads, which make ideal locations for spray cards, will be used when possible. Each card will be placed 0.2 miles apart. The time required in laying out and picking up cards will be minimized by using a two-man crew. One man will drive the car and record the card number and location on a map. The other man will place and retrieve the cards.

Cards will be gathered the same day the area is sprayed or early the next morning. Cards will be given to the project entomologist or assistant entomologist who will estimate spray coverage by comparing with a set of standards.[1/]

Results of the estimate will be tabulated on Work Sheet #19 and sent to the project director. In cases of inadequate coverage, the project entomologist will check larval mortality due to spraying in the area in question and notify the project director if respray is necessary. All spray deposit cards will be saved for future reference.

REPORTING OF RESULTS

The project entomologist will prepare a final report summarizing the entomological phases of the project soon after the project is completed.

1/ Davis, J.M. Standard for estimating airplane spray deposits on oil-sensitive cards, Forest Serv., U.S. Dept. Agr., Wash., D.C. 1954.

NOTES FOR TECHNICAL PERSONNEL

This section is designed as a guide and aid for those who may not be experienced in Douglas-fir tussock moth control projects. These notes have been prepared to answer some questions that arise on the job and ease some of the quandaries of the project entomologist and his assistants.

The positions of entomologist and insect checkers on a Douglas-fir tussock moth control project are of tremendous importance. The work performed by these men is the basic essential for efficient control of the tussock moth by aerial spraying.

The essence of this control project is the proper timing of the release of individual spray blocks as determined by the larvae hatching from the eggs. All the entomological decisions determining the release of spray blocks for treatment will be made by the project entomologist.

A. Collecting Data

1. Egg Hatch - It is often impossible to sample egg hatch in all spray blocks. In many cases, reasonable comparisons can be made of the development on a known spray block with that on an inaccessible block. These comparisons can be made by using like elevations, direction of slope, exposure, dominant tree species, and other ecological factors. In general, the rate of egg hatch likely to occur in the following order of exposure at similar elevations: South, west, east and north slopes. Eggs will probably hatch earlier at lower elevations except in dark, cold canyons.

2. Larval Development - There is one generation a year. The Douglas-fir tussock moth overwinters in the egg stage on the female cocoon on branches and on trunks, or on a variety of objects some distance from a tree. The larvae may begin hatching from the eggs in May and continue through June. These newly hatched larvae are only one-eight-inch long, light in weight, and covered with long gray hairs that allow them to be carried by wind. Since the females do not fly, major dissemination of the population is by windborne larvae. Once the newly hatched larvae settle down, they begin to feed on both old and new foliage. Although the larvae begin feeding in May and June, the more noticeable feeding does not occur until the middle of July and continues until the caterpillars pupate any time from late July through September. Pupation occurs inside a thin cocoon of silken webbing mixed with larval hairs, and the moths appear 10 to 18 days later to start the life cycle over again.

3. Completion of Forms - At the time of the first collection at each regular collection point or spot check, the collector must

record all the data required to complete the heading on Work Sheet #15. This information will be promptly turned over to the assistant entomologist who will make sure all data have been secured.

All technical personnel are cautioned to be certain that all data required on the several forms to be used on the 1965 project are obtained. Each man will take time to completely fill out all form headings and labels.

4. Labeling - As with forms, the importance of recording all information required and desired cannot be stressed too strongly. The clarity and neatness of labels placed at each egg mass, mortality plot, and on each vial are of vital importance to the entomologist.

5. Coding - The following coding system will be used on insect specimen labels and field and office forms on the 1965 tussock moth control project.

Control Unit:	Antelope	-	A
	King Mountain	-	K
	Gold Hill	-	G
	Vance Creek	-	V
	Silver Springs	-	S
Block Unit:	Alphabetically A through L depending on size of control unit.		
Type of Sample:	Observation Point	-	OP
	Mortality Plot	-	MP
	Random Sample	-	RS

Numbering will run consecutively for each type of sample as follows:

A-AOP 1 - Antelope control unit, block A, observation point #1.

K-EMP 1 - King Mtn. control unit, block E, mortality plot #1.

G-ARS 1 - Gold Hill control unit, block A, random sample #1.

6. Spot Checks - As the time for spray block release approaches, sampling activity increases. Regular daily egg hatch observations

at designated observation points will become difficult to obtain. Consequently, spot observation checks will usually become dominant. The entomologist and assistant entomologist will specify portions of blocks from which spot checks are needed. The assistant entomologist or insect checkers will obtain spot checks in remote or inaccessible blocks. By this time, sufficient daily observations will have been made to provide adequate comparisons for spot checks.

B. Releasing Blocks for Spraying

Spray blocks will be released when most larvae have hatched in the block. There will be much variation in the hatch by elevational zones, between individual egg masses and location of egg mass. It is important to remember that it is the total egg hatch that will govern the actual release of spray blocks or portions of blocks.

Blocks may be split and released for spraying as insect development warrants.

Just as soon as a spray block is ready for release, as indicated by egg hatch, give it a priority for spraying. Notify the project director by use of Work Sheet #16.

Once a block is released for spraying, the project director will treat it as quickly as possible by the priority established by the project entomologist.

C. Mortality Lines

The success of a Douglas-fir tussock moth control project is determined by the over-all average percent of tussock moth larval mortality. The end result of the entomological phase of the project will be an expression of percent mortality. Consequently, obtaining data for this phase cannot be overemphasized.

Care must be taken to insure accuracy, neatness, and clarity of data taken on a mortality line. This is particularly true in obtaining, counting the 100 larvae placed in each mortality box, and replacing the lid soon after the area has been sprayed.

D. Adequacy of Spray Deposits

The entomologist will be issued one set of "Spray Deposit Index" cards with instructions for their use. In case of inadequate spray deposit, as indicated by the index, an examination of the foliage of broadleaf plants, such as wild strawberry, wild rose, California hazel, willow, manzanita, and vetch, should be made by the man picking up the spray deposit card. On these plants, the oil within the spray droplets will "burn" yellowish-brown spots wherever they land on the foliage. A film of oil on

pools of water, larval webs and odor of the insecticide are also indications that some spray reached the ground. These are auxiliary indications and should be used with extreme caution.

Observations should be made and notes taken by the collector of these indications when spray deposit cards show "misses" or very light coverage.

E. Larval Characteristics

The Douglas-fir tussock moth passes through five instars prior to pupation. Molting is the process of transformation by which the larvae change from one instar to another. The following table was extracted from the Intermountain Forest and Range Experiment Station 1959 Winter Quarterly Report and will be used as a guide in determining the different larval developmental stages when necessary.

Instar 1/	Head Capsule Width (mm)	Body Color
I	.4 - .6	Black, with long hairs all over.
II	.6 - .9	Gray black hairs, somewhat shorter.
III	1.0 -1.4	Two black tufts and orange spots "Horn and tail" spikes well developed.
IV	1.6 -1.9	Four yellow to brown tufts on back. "Horn and tail" spikes well developed.
V	2.0 -2.4	Not described.

1/ Normally there are 5 instars. However, there is some evidence that female larvae may go through up to 7 instars and male larvae may go through up to 6 instars.

SUMMARY OF INFORMATION AND EDUCATION ACTIVITIES

Information and education activities began in August 1964 as soon as it became apparent that the Burns Douglas-fir tussock moth infestation had reached epidemic proportions. An initial press release announced that a control project may be necessary in the spring of 1965 to avoid serious timber losses. In October 1964, a field trip to view dead and dying timber was attended by some 50 persons, including representatives of private industry, county government, State Department of Forestry, Bureau of Land Management, Public Health Service, State Game Commission, and the Wildlife Management Institute. The control project was then endorsed by the Harney County Court, the Northwest Forest Pest Action Council, and the Harney County Chamber of Commerce. The tussock moth problem, and the probable need for a control program, was also explained to the Forestry Committee of the Oregon State Cattlemen's Association at the Association's annual convention in November. Although no action was taken, the cattlemen appeared sympathetic to the project.

A formal information and education plan was prepared, designating specific assignments to be accomplished before, during, and after the project. Personnel from the Forests and the Regional Office began an intensive effort to personally contact key groups and individuals, including timber operators, sportsmen and grazing permittees. Letters signed by Regional Forester Stone were sent to Senators Morse and Neuberger, and Congressman Ullman, to describe the project and to outline measures to protect other resources from side effects. A project brochure, "Saving the Forests," was prepared and 3,500 copies were printed. Distribution was made throughout the Region, including news media and individuals on the key Multiple Use Highlights mailing list. Two portable pictorial exhibits were prepared to show the project map, color photos of defoliation, and black and white pictures of the insect life cycle and helicopter spraying. One exhibit was sent to John Day for display in public buildings, and one was set up in the window of project headquarters at Burns. Copies of the project brochure accompanied the exhibits for public distribution on a "help yourself" basis. Project headquarters was identified by especially painted signs and visitors were welcomed.

Press releases were being made at timely intervals. The Oregon Journal on May 22, 1965, ran an editorial implying support of the project--"The Burns tussock moth project appears to be a conscientious attempt to strike the needed balance between the values that can be saved by spraying and the damage that spray can cause other forms of life." In line with the information and education plan, a press kit was prepared for distribution to approximately 25 news media who may be interested in personal coverage of the project.

As the starting spray date drew near, the project was entirely free of public controversy. Barring an unforeseen incident, no opposition is anticipated.

SURVEILLANCE PLAN

The Forest Service has planned and will carry out in June 1965, a DDT spray project to control tussock moths on about 55,600 acres north of Burns, Oregon. In order to study effects of the control program on physical and biological factors other than the target species, the Forest Service requested that appropriate public agencies participate in a cooperative surveillance project. The Forest Service has assigned a surveillance coordinator who will draw together the efforts and act as liaison among cooperating agencies.

Specific programs have been submitted by cooperators. Actual participation may differ somewhat from present plans depending on the spraying operation itself, observations made during the spray period, and results of preliminary residue analyses.

Current planning indicates that the surveillance will provide short-term information on the contribution of project DDT application to residue levels in big game, fish, aquatic insects, water, range cattle, and forage. Long-term research programs will study DDT levels and persistence in an aquatic environment, and movements of the chemical and its metabolites from conifer litter through soil profiles.

Cooperators participating in the surveillance include:

Agency	Representative
Oregon Stage Game Commission	Robert L. Borovicka
Oregon State University Dept. of Fisheries and Wildlife	Gerald E. Davis
U. S. Fish & Wildlife Service Bureau of Sport Fisheries & Wildlife	William M. Morton
U. S. Forest Service, Pacific Northwest Forest & Range Experiment Station	
Watershed Management Research	Robert F. Tarrant
Range, Wildlife, & Recreation Management Research	Gerald S. Strickler
National Forest Administration, R-6	
Range & Wildlife Management	Charles B. Waldron
Malheur National Forest	Herbert B. Rudolph
Surveillance Coordinator	Glenn L. Crouch
U. S. Agricultural Research Service Entomology Research Division	Lillian I. Butler

The evaluation by the Oregon Game Commission on the effects of the tussock moth control project to wildlife will be confined to determining the levels of DDT residues in big game animals prior to and immediately after the control spraying and during deer and elk hunting seasons. The surveillance of the tussock moth control that will be related to the fishery resource will consist of pre-spray, spray period, and post-spray work on water, coho salmon ova, fish, insects, and related aquatic life. The plan is designed to observe mortalities, if any, and make collections for future analysis to determine DDT residues. General observation will be conducted on all spray units. Specific study plans have been developed for the Vance Creek and King Mountain Units.

The Department of Fisheries and Wildlife from the School of Agriculture and Agricultural Experiment Station at Oregon State University plan to determine levels of DDT and/or its metabolites and the persistence of such residues in different parts of a natural aquatic food chain.

The Bureau of Sport Fisheries and Wildlife of the Fish and Wildlife Service has proposed a study for pesticide surveillance at Malheur National Refuge in 1965. During the spring of 1965, several thousand acres of forest land within the Silvies River watershed will be sprayed with DDT for control of the tussock moth. In view of the potential threat to the water quality of Malheur Lake and the Malheur Refuge by pesticide contamination, a surveillance study is believed desirable. This proposed study is designed to follow a pattern similar to recent studies conducted by Jim Keith at Tule Lake, Lower Klamath, McNary, and Deer Flat National Wildlife Refuges.

The Division of Watershed Management Research of the Pacific Northwest Forest and Range Experiment Station has planned a study to determine how much DDT residue is present before spraying and over at least three years after spraying, in:

1. Litter, L and F layers, and mineral soil at depths of 0-3 and 3-6 inches;

2. Litterfall;

3. Precipitation passing through the tree canopy; and

4. Stream water leaving the spray area.

The Division of Range and Wildlife Management of the U. S. Forest Service, Regional Office, and Malheur National Forest have planned a study to determine the contribution of the Burns tussock moth spray project to DDT residue levels in National Forest permittee range cattle. Cattle fat samples will be obtained before turnout on the National Forest and after the summer grazing season. Dates for sampling will be approximately June 1 and October 10, 1965. Samples will be obtained from mature cows

owned by a National Forest permittee utilizing the Antelope Mountain spray unit. A total of 10 cows will be sampled before spraying and after. Samples will be obtained from the same cows before and after spraying. Test cows will be marked with ear tags and neck chains, and weights of each animal will be obtained at the times of sampling. Sampling will be done by a contract veterinarian and obtained by biopsy from the upper hind-quarter of the animals by making a one-inch incision and scooping out 10-20 grams of fat with a surgical instrument. Fat samples will be placed in containers supplied by Agricultural Research Service, Yakima, Washington, frozen, and shipped to their laboratory for analysis.

The Division of Range, Wildlife and Recreation Management Research of the Pacific Northwest Forest and Range Experiment Station has planned a study to determine the possible role of certain range forage plants as food chain carriers of residues from DDT aerial spray applications. Principal objectives are to determine: (1) The amount of DDT residues reaching understory forage species following aerial spray applications within the Antelope Mountain allotment, Malheur National Forest, and (2) the amount of DDT residues associated with herbage of the same species four months and twelve months after spray application.

The Entomology Research Division of the Agricultural Research Service agrees to analyze the following materials for residues of DDT and metabolites. Samples will be collected by surveillance program co-operators.

Substance	Number of samples		
	1965	1966	Total
Grouse	10	0	10
Big game	50	10	60
Cattle	55	0	55
Fish and insects	50	0	50
Forage	140	40	180
Water	50	0	50
	355	50	405

In addition, the Agricultural Research Service will provide technical advice to the surveillance program.

Other groups may make observations during spraying operations, but will not conduct formal studies as part of the surveillance program.

At a suitable time, a surveillance committee report will be compiled from individual cooperator contributions. In addition, progress reports will be issued when appropriate.

APPENDIX

BIOLOGICAL EVALUATION OF DOUGLAS-FIR TUSSOCK MOTH

A biological evaluation of the Douglas-fir tussock moth outbreak on the Malheur and Ochoco National Forests was made during September and October 1964.

A. Defoliation and larval populations - At Antelope Mountain, King Mountain, and Gold Hill areas, defoliation to true firs and Douglas-fir understory was heavy with complete defoliation of trees in some localized areas. Tree mortality in these stands will be heavy. There was little old evidence of feeding from 1963 and few old egg masses were observed.

Defoliation at Vance Creek on the Malheur National Forest and at Snow Mountain on the Ochoco National Forest was light and confined to the tops of mature and young trees.

Due to a warm dry fall following a cool summer, the larvae fed late into September. On October 15, moths were still emerging and mating, however, the majority of egg laying occurred early in October.

Larval populations at mid-September were heavy at Antelope and King Mountains and moderate on Gold Hill. Quite a few dead larvae were present at Gold Hill.

B. Incidence of virus - During September dead and live larvae were collected from selected plots within the infested area. These larvae were sent to the Forest Science Laboratory, Corvallis, Oregon where Dr. C.G. Thompson examined them for the incidence of a polyhedrosis virus. This virus has been given credit for the collapse of many tussock moth outbreaks in the past and is credited with the decline in the outbreak presently underway in eastern Washington.

Dr. Thompson reported virus-caused mortality very low to absent with none in 12 of 18 samples collected from plots at Antelope Mountain. There was considerable variation in the King Mountain area with the virus low to absent in the southern and eastern areas. At Gold Hill there was a high incidence of virus-caused mortality.

C. Egg survey - In mid-October a tussock moth egg survey was made at 30 selected plots in these three areas. A count was made and a ratio compiled of the number of old tussock moth egg masses to new egg masses. Past studies have shown this ratio to be a good indicator of the trend of these outbreaks. Egg collections from Antelope showed 14 new egg masses for each old egg mass. The trend was upward on all plots in the area. This ratio of 14:1 is the highest reported from any tussock moth outbreak in the United States for which we have records.

King Mountain unit collections contained 7-1/2 new egg masses for each old egg mass, with the trend up on all plots.

In the Gold Hill area the egg ratio was up on three plots and down on three plots with a 1:1 ratio for the average of all plots.

One collection made in the Vance Creek area contained three new for each old egg mass. No collections were made in the Snow Mountain area as most of the feeding is still in the tops of large trees. The only egg masses that were observed in this area were new.

Conclusions - Using the larval population counts, virus incidence, and egg ratio surveys as indicators of the trend of the outbreak, it is believed that heavy tussock moth populations will be present in all areas in the spring of 1965. Defoliation should be heavy early in the season but the virus may reduce the population in the Gold Hill area. This may not happen until after considerable defoliation has occurred, as virus mortality normally appears in the late larval instars.

DOUGLAS-FIR TUSSOCK MOTH EGG HATCH RECORD

UNIT_____ SPRAY BLOCK_____ COLLECTION POINT NO._____

T._____S., R._____E.; SEC._____ ELEVATION_____FT. EXPOSURE: N E S W

BLOCK RELEASED_____ BLOCK SPRAYED_____ COLLECTOR_____
Date Date

Tree No.	Egg Mass No.	Egg Mass Location	Date Egg Hatch		Date Egg Hatch		Date Egg Hatch		Date Egg Hatch		Date Egg Hatch		Date Egg Hatch	
			No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
I	1													
	2													
	3													
	4													
	5													
II	1													
	2													
	3													
	4													
	5													
III	1													
	2													
	3													
	4													
	5													
IV	1													
	2													
	3													
	4													
	5													
V	1													
	2													
	3													
	4													
	5													

DOUGLAS-FIR TUSSOCK MOTH CONTROL PROJECT

Notification of Release of Spray Blocks

Date: _____

To: _____, Project Director

From: _____, Project Entomologist

The following described spray blocks will be ready for spraying on _____, _____, in the priority listed below:
(day) (date)

Priority	Block No.	Total Acres	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Total acreage released by this notice: _____ acres.

Unless otherwise stated, the lower elevations of each block should be sprayed first if the period of spraying each block exceeds one day.

Approved: _____
Project Entomologist

If this is a verification of a release by earlier communication, such release was given by me on _____ (date), by _____ communication.

1 copy each to: Project Director
U.S. Forest Service (Div. Timber Mgmt.)

DOUGLAS-FIR TUSSOCK MOTH LARVAL

DEVELOPMENT RECORD

CONTROL UNIT _____ SPRAY BLOCK NO._____

T._____S., R. _____E., SEC. _____

BLOCK RELEASED_____ SPRAY BEGUN_____

Collection Point Number	LARVAL INSTARS							
	I		II		III		IV	
	No.	%	No.	%	No.	%	No.	%

DOUGLAS-FIR TUSSOCK MOTH MORTALITY RECORD

UNIT_____ SPRAY BLOCK_____ DATE RELEASED_____

PILOT_____ DATE (S) SPRAYED_____

DATE PLOT ESTABLISHED_____ DATE PLOT COLLECTED AFTER SPRAY_____

Collection Point Number	Plot Number	Larvae Count Prior To Spray	Larvae Count After Spray		Percent Mortality
			Dead	Live	

SPRAY DISTRIBUTION RECORD

Unit_____ Spray Block No._____ Line No._____

T._____S.,R.____E., Section_____ Pilot_____ Checker_____

Local Landmark_____

Line Starts At_____

Date Laid Out_____ Time Laid Out_____ Date Picked Up_____Time Picked Up___

Card No. Start _____ Card No. End_____

Card No.	Spray Deposit G/A	Spray Coverage	
		Satisfactory	Unsatisfactory

DOUGLAS-FIR TUSSOCK MOTH PROJECT PROGRESS REPORT

UNIT_____

Spray Block	Elev.	Acres	Coll. Pts. Est.	Mort. Plots Est.	Block Re-leased	Spray Cards Laid Out	Spraying		Pilot	Spray Cards Picked Up	Mortality %
							Began	Finished			
A											
B											
C											
D											
E											
F											
G											
H											
I											
J											
K											
L											

DAILY RECORD OF HELICOPTER OPERATION
(BURNS DOUGLAS-FIR TUSSOCK MOTH CONTROL PROJECT)
MAY - JUNE 1965

_____Unit Heliport no._____

Date_____1965 Helicopter no._____ Pilot_____

Spray capacity_____ (gallons) Swath width_____ (feet) Heliport Manager _____

Time off	Time back	Air time	Metered gallons loaded	Cumu-lative total	Nurse truck no.	Spray block	Acres	Sub spray block	Acres	Remarks

5250 FLIGHT LOG FOR OBSERVATION HELICOPTERS 26

_____ Unit Helicopter no._____ Date_____

Pilot's name_____ Contractor's name_____

Time out	Time in	Hours & tenths flying time	Where refueled	Refueling gas in gallons	Description of Flight Block numbers, areas, destination, etc.
Total			Total		

This form to be turned in to clerk at end of each day's flying (3 copies).

Pilot Signature Observer Signature Project Director or Asst.

26 FLIGHT LOG FOR OBSERVATION HELICOPTERS 5250

_____ Unit Helicopter no._____ Date_____

Pilot's name_____ Contractor's name_____

Time out	Time in	Hours & tenths flying time	Where refueled	Refueling gas in gallons	Description of Flight Block numbers, areas, destination, etc.
Total			Total		

This form to be turned in to clerk at end of each day's flying (3 copies).

Pilot Signature Observer Signature Project Director or Asst.

DAILY PROGRESS REPORT

BURNS DOUGLAS-FIR TUSSOCK MOTH PROJECT

UNIT _____

Date _____

1. Acreage sprayed today _____
2. Acreage previously reported _____
3. Total unit acres _____
4. Total acres sprayed to date (1 plus 2) _____
5. Acres remaining to be sprayed (3 minus 4) _____
6. Helicopter equipment on the job: _____

_____

_____

_____

Other _____

7. Flying time, spray helicopters Hrs._____ Min._____
8. Flying time, observation helicopters Hrs._____ Min._____
9. Weather conditions: _____

_____

10. Problems: (Remarks) _____
11. Accidents: (Remarks) _____

_____

12. Remarks: (General) _____

_____

_____

_____

AERIAL OBSERVATION REPORT

DOUGLAS-FIR TUSSOCK MOTH CONTROL

UNIT_____

1. Spray Helicopter No._____ Pilot_____ Spray Block #_____ Time_____
2. Swath Width_____
3. Spray Plane Height_____
4. Leaks or Plugged nozzles_____
5. Spray Action & Time Observed_____
6. Spray Pattern Near Non-Spray Areas (lakes, streams, etc.)_____

_____

7. Is Spray Plane in proper block, pilot oriented, etc. _____

_____

8. Stop watch time for spraying load
   Minutes_____ Seconds_____
   Minutes_____ Seconds_____
   Minutes_____ Seconds_____

Observer_____

Observation Ship No. _____

Date_____

SPRAY BLOCK RECORD
DOUGLAS-FIR TUSSOCK MOTH PROJECT

Block No. _____ Computed Acreage_____ Average Miles to Block Center_____

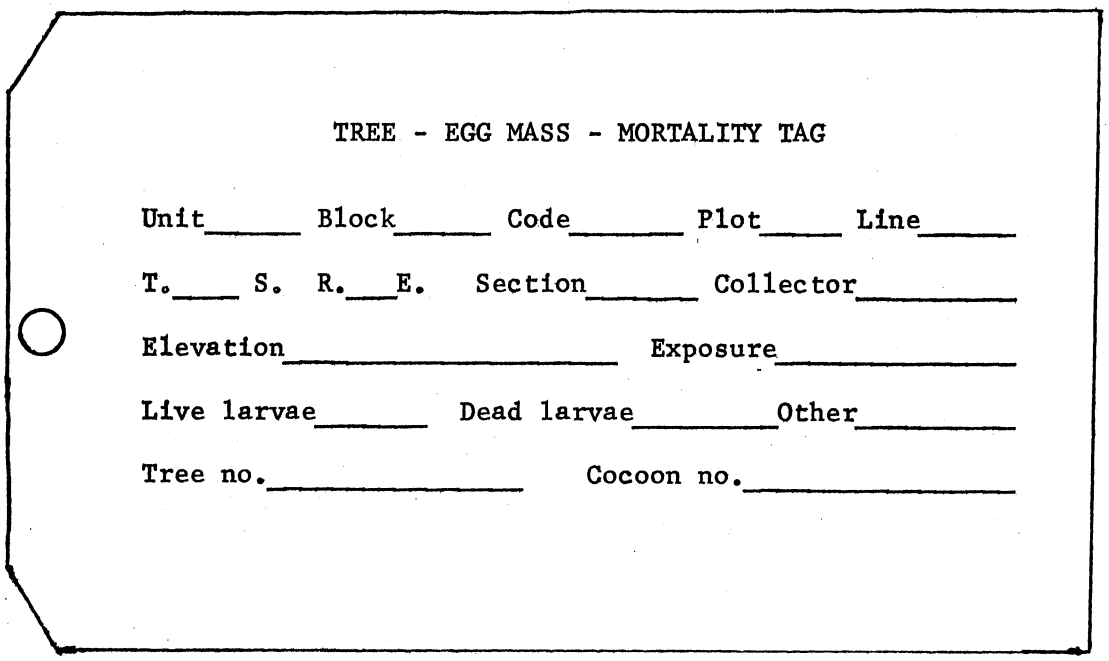
Helicopter No. _____ Pilot_____ Helicopter Maximum Allowable Gallons _____

Name of Load Checker_____ Heliport No._____

	(1)	(2)	(3)	(4)						
Date	Load in Gals.	Cumulative Gallons Sprayed	Acres Sprayed OK	Cumulative Acres Sprayed OK	Beginning and ending Meter Readings	Gas in Gals.	Take Off Time	Time of Return	Elapsed Time in Minutes	Remarks
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					
					E_____ B					

Totals

1. Must equal figure determined by subtraction of beginning and ending meter readings.
2. Includes all gallons ordered resprayed by Project Director.
3,4. Represents acres determined satisfactorily sprayed with help from ground checking methods


TREE - EGG MASS - MORTALITY TAG
Unit_____ Block_____ Code_____ Plot_____ Line_____
T.____ S. R.___E. Section_____ Collector_____
Elevation_____ Exposure_____
Live larvae_____ Dead larvae_____Other_____
Tree no._____ Cocoon no._____

VANCE CREEK

GOLD HILL

ANTELOPE MOUNTAIN

SILVER SPRINGS

KING MOUNTAIN

U S DEPARTMENT OF AGRICULTURE
FOREST SERVICE

MALHEUR NATIONAL FOREST
AND
OCHOCO NATIONAL FOREST
OREGON
WILLAMETTE MERIDIAN

LEGEND

DOUGLAS-FIR TUSSOCK MOTH CONTROL
BURNS PROJECT
1965

Proposed Spray Areas	Approx. Acres
King Mountain	23,766
Antelope Mountain	18,646
Gold Hill	9,106
Silver Springs	3,544
Vance Creek	571
	55,633